

**JSBA Pedigree & Cluster Analysis Results**  
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Pedigree and cluster analyses were performed using data from the JSBA. There were 9,268 records from 1982 to May 2005.

*Data Edits*

The data file was edited for consistency, including correcting non-matching sex codes (RAM vs R), non-matching unknown parents (unk, unknown, none), and names in parent registration number fields. Many animals had leading zeroes that were different between their own registration number and their registration number when they appeared as a parent. In order to correct this, leading zeroes were removed from registration numbers. There were unknown birth years for 23 percent of the data. In order to include this data in the inbreeding trend, the year of registration was assumed to be the birth year. There were 30 individuals that appeared as both a sire and a dam. The correct gender was pulled from the data and where the individual appeared as the wrong gender, those records were converted to unknown. For example, if male 123 was listed as both a sire and a dam, the records where he appeared as a sire were left alone, but where he appeared as a dam, the dam registration number was changed to unknown.

*Inbreeding*

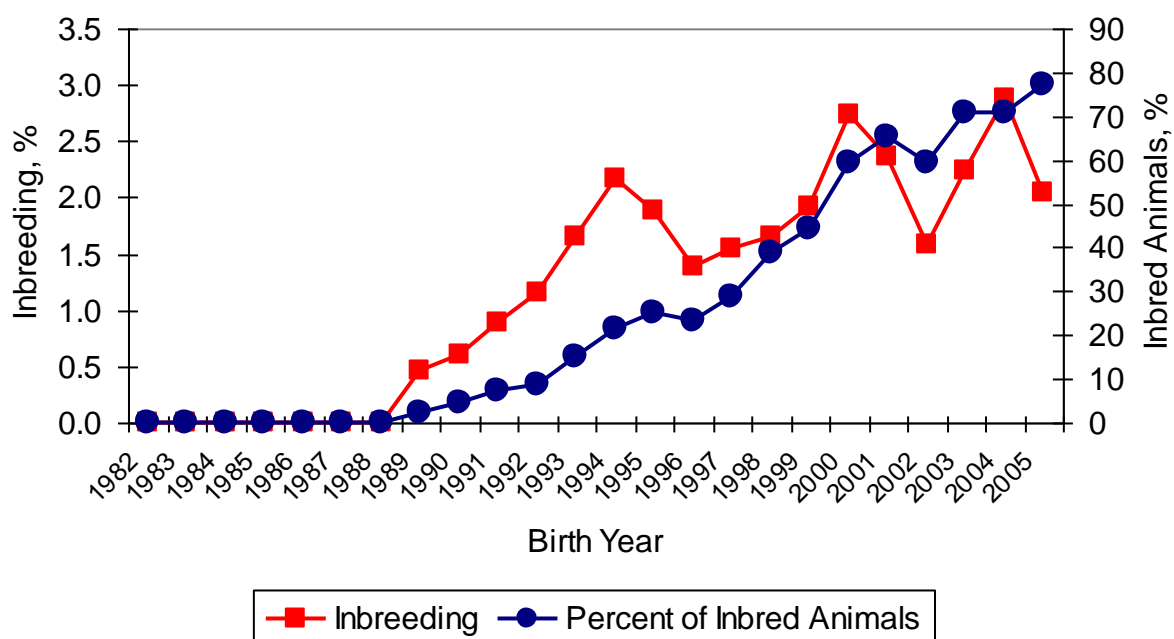
The pedigree file was traced back as far as the pedigree would go, resulting in 9,400 records in the final pedigree. Since the pedigree is fairly shallow, the first inbreeding doesn't occur until 1989, which is highly unlikely in this population. The true inbreeding levels are unknown, but are expected to be higher than calculated. There were 1,195 sires and 3,133 dams. The average calculated inbreeding for all animals was 1.6 percent, with a range from 0 to 46.9 percent. The frequency distribution of inbreeding percentage is shown in Table 1. The vast majority of animals (67.3 percent) have an inbreeding coefficient of zero and many (22.9 percent) are less than 5 percent inbred. However, there are a considerable number of animals that are moderately inbred.

The inbreeding trend and percent of inbred animals is shown in Figure 1. Although average inbreeding is low, it has increased over time. There has been a corresponding increase in the number of animals over time with an inbreeding coefficient greater than zero. In 2005, almost 80 percent of animals were inbred.

**Table 1. Frequency distribution of inbreeding in Jacob sheep, 1982-2005**

F, %	Number Animals
0	6,325
0 to 5	2,149
5 to 10	407
10 to 15	275
15 to 20	63
20 to 25	112
25 to 30	46
30 to 35	11
35 to 40	9
40 to 45	2
> 45	1

**Figure 1. Inbreeding trend and percent inbred by birth year**

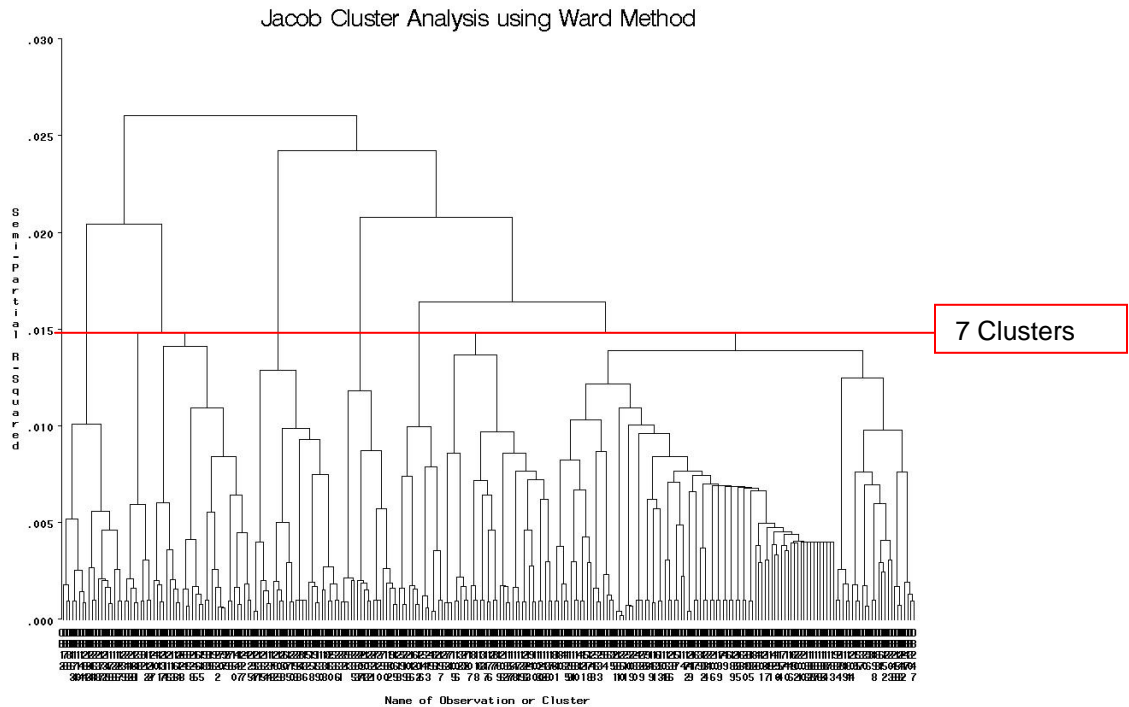


### *Cluster Analysis*

A cluster analysis, based upon the genetic relationships between JSBA sheep, was performed to determine which rams should be collected for the NAGP repository. Rams included in the cluster analysis included sires of 2004 and

2005 born lambs, rams born in 2004 and 2005, and rams in the NAGP repository. This was assumed to be the available pool of rams from which collections could be made. There were 264 rams in the cluster analysis and 7 clusters were determined to be the number of distinct groups of rams that should be targeted for collection. Figure 2 shows a graph of how the clusters are formed.

**Figure 2. JSBA Cluster Graph**



**Table 2. Relationship within clusters**

Cluster	N	Mean	Variance	# Rams in Repository
1	146	0.018	0.003	2
2	14	0.154	0.026	
3	27	0.148	0.016	
4	31	0.135	0.017	2
5	18	0.176	0.023	
6	19	0.197	0.022	
7	9	0.296	0.021	

Table 2 shows how the 264 rams broke into 7 distinct clusters. There were 6 small clusters of closely related animals (0.13 - 0.30) and 1 large cluster with an average relationship of 0.02. Cluster 1 is typical for cluster analyses; there are 1 or 2 large clusters where lowly related animals get placed.

Table 3. Relationship between clusters							
Cluster	1	2	3	4	5	6	7
1	0.018	0.007	0.017	0.023	0.015	0.018	0.022
2		0.154	0.006	0.009	0.004	0.007	0.011
3			0.148	0.041	0.016	0.030	0.031
4				0.135	0.016	0.050	0.071
5					0.176	0.033	0.018
6						0.197	0.062
7							0.296

Table 3 demonstrates the effectiveness of the clustering procedure. There is a high degree of relatedness within clusters (the diagonal), with the exception of cluster 1. The relationships between clusters are low, indicating the clusters are unique.

To develop a secure collection of Jacob semen we would like to have collected 20 to 30 rams. These results suggest rams from all clusters be collected, with heavier sampling of the rams from cluster 1. A list of rams by cluster is provided in Appendix 1 so a collection strategy can be developed. Highlighted rams are already in the NAGP repository. Care needs to be taken within cluster to select rams that are as lowly related to one another as possible.

## Appendix 1. Rams by cluster

Reg. #	Name	Cluster
A107-01	UnzickerSpence	1
A11-03	ChicoryLaneCarleton	1
A12-05	ChicoryLaneChaucer	1
A142-03	ChicoryLanePhoenix	1
A16-05	MoonstruckBlackberry	1
A20-04	PaintedRockFreddie	1
A28-05	LilacMtnB.Wellington	1
A29-05	FibreFoldsEstes	1
A32-05	OldOrchardCassius	1
A35-04	AmazingGraceAbner	1
A43-00	SouthwindSenorQuioxte	1
A46-03	UnzickerMatthias	1
A52-02	HurricaneHilGiacomo	1
A55-03	ScrubBrushDominator	1
A57-04	UnzickerTyler	1
A59-04	PerfectSpotLazarus	1
A61-03	MapleHillTitus	1
A64-04	SouthwindMayhem	1
A70-04	bideaweeCamden	1
A71-00	SouthwindLegacy	1
A72-02	LilacMountainCabot	1
A73-04	RollingOaksLance	1
A74-01	BullthistleHoss	1
A91-01	PuddleduckShamus	1
B101-02	SouthwindSam	1
B105-04	BullamankaP-116	1
B106-04	ChicoryLaneHunter	1
B110-00	MaverickJeeves	1
B110-04	Say-WatWilliamTurner	1
B111-04	Say-WatChocolateChips	1
B115-99	ZeeWooliesRogan	1
B127-98	SweetgrassGibson	1
B129-97	Craft'sHershey	1
B138-96	StorybookGeorge	1
B15-05	PerfectSpotPatton	1
B16-05	LangbankRupert	1
B182-00	HaycockAubrey	1
B19-05	FibreFoldsEsteban	1
B191-98	Brink-MaySirCalvin	1
B21-02	4HornFarm'sDurango	1
B31-03	MurrayBay'SirPrize'	1
B31-98	MagicMoonCaptainHook	1
B32-03	PatchworkDandy	1
B37-01	BrookfieldArthurDent	1
B4-03	MarischalDoug	1
B6-05	WildAcresFireball	1
B63-04	MagicMoonBazil	1
B63-99	NewberryRocky	1

B78-01	Weber'sThistle	1
B79-04	FleeceMillHurricane	1
B80-04	FleeceMillBlizzardBumBum	1
B83-03	HillsideJoy'sLynn	1
B84-03	MeridianPete	1
B90-04	PerfectSpotMontague	1
B93-03	StonecroftJulian	1
B99-99	Alber'sChaucer	1
C1-01	Craft'sBergen	1
C10-04	PuddleduckDavid	1
C10-05	Brink-MaySirChavalier	1
C111-00	Craft'sPercy	1
C115-04	UnzickerJeremiah	1
C116-04	HillsidePete	1
C119-04	Craft'sKirby	1
C124-02	JennyJumpBentley	1
C130-00	Oak'sEdgeJebediah	1
C132-04	SouthwindMarcus	1
C133-04	SouthwindMathias	1
C134-04	LilacMountainSirBilly	1
C135-04	Kenleigh'sDouglas	1
C150-01	Craft'sFairbanksMorse	1
C159-00	Craft'sMr.Gable	1
C166-03	PuddleduckJarrett	1
C171-03	bideaweeKell	1
C174-03	SweetgrassDunedin	1
C177-03	Craft'sMcCall	1
C179-03	bideaweeDane	1
C232-03	PuddleduckSilas	1
C36-04	ZeeWooliesThomasO'Malley	1
C41-03	BullthistleBarberry	1
C53-03	Craft'sGifford-Pinchot	1
C58-04	SweetgrassChris	1
C67-98	Jacquee'sJunco	1
C74-02	SweetgrassDustin	1
C75-98	Craft'sRoby	1
C80-04	Dandy'sZarah	1
C81-03	BullthistleBrotherJudson	1
C89-02	UnzickerSundance	1
C9-03	MarischalBill	1
C91-02	SweetgrassAidan	1
C92-01	PuddleduckMichael	1
C92-04	HillsideSpringtime'sNewberg	1
C98-01	PJ'sMountainViewSimon	1
C98-03	LangbankWings	1
C98-99	StoneHedgeElijah	1
D13-05	HurricaneHillJohnDeere	1
D28-04	HillsideLuna'sAlexander	1
D29-01	Craft'sMorgan	1
D33-04	UnzickerIves	1

D41-04	Craft'sMaestro	1
D42-04	Craft'sTomlin	1
D43-04	Craft'sMarcellus	1
D44-04	HurricaneHillJozepi	1
D45-03	SouthMt.Reno	1
D56-04	HurricaneHillJeremy	1
D7-04	SweetgrassNimbus	1
D9-05	SnookFarmMark	1
E3-04	StarLightSolomon	1
FF11-03	Lo-CoMeadowsHouston	1
FF11-04	OvertheGrass49	1
FF12-04	OvertheGrass22	1
FF13-04	OvertheGrass50	1
FF14-04	OvertheGrass23	1
FF15-05	BelmeadowPeregrine	1
FF20-02	McClainsMaverick	1
FF22-05	SwanValleyDude	1
FF30-04	PerfectSpotSteadfast	1
FF35-03	WalnutGlenIsaiah	1
FF40-01	MadRomanceRomeo	1
FF58-04	MHEMax	1
FF6-03	CullodenIsaiah	1
FF6-04	HuntsbergerCabot	1
FF6-05	OldOrchardRebus	1
FF69-03	HuntsbergerDrummond	1
FF71-04	Thorpe'sKipling	1
FF79-00	SilberEldorado	1
FF82-04	MurrayBaySirPoppy	1
FF84-04	Craft'sBronteBuddy	1
FF95-03	HuntsbergerRoyal	1
T11-04	Brink-MaySirTrahern	1
T12-04	Brink-MaySirThaddeus	1
T29-04	UnzickerJeremiah	1
T31-04	SchafewaldSerento	1
T38-04	Kenleigh'sBramble	1
T39-00	Kenleigh'sBirch	1
T4-05	Kenleigh'sJaq	1
T40-05	WindyAcresMacKinney	1
T46-05	RidgecroftClyde	1
T5-05	Kenleigh'sWatson	1
T51-04	LangbankRio	1
T53-04	LangbankLeonard	1
T56-04	LangbankLinc	1
T57-04	LangbankChesney	1
T6-05	Kenleigh'sBernard	1
T61-04	SouthMt.Harley	1
T63-04	StarrfireLazarus	1
T64-04	StarrFireDaniel	1
A61-04	LakeFarmparkJester	2
B15-03	Glen'sSpikeLee	2

B23-04	HollowHillHappyFella	2
B34-03	StrattonHallEli	2
B39-03	JoyFarmSalmon	2
B5-05	Glen'sSilentBob	2
C125-00	JoyFarmJoel	2
C15-05	StrattonHallTravis	2
FF59-96	Belfield'sSt.Patrick	2
T107-04	StrattonHallTrevor	2
T13-05	BrokenEweBrier	2
T18-05	HollowHillWinterberry	2
T20-04	JoyFarmHelez	2
T21-04	JoyFarmHeman	2
B21-05	GreenwaterStephan	3
B22-05	GreenwaterMike	3
B37-00	MaverickCapone	3
B92-01	GreenWaterJose	3
B94-01	GreenWaterBlake	3
C104-01	GreenWaterPhillip	3
C138-02	GreenWaterJulian	3
C179-01	GreenWaterJohn	3
C28-05	GreenwaterTim	3
C34-05	GreenwaterBuster	3
C36-05	GreenwaterDan	3
C40-05	GreenwaterRames	3
C41-05	GreenwaterShawn	3
D17-05	GreenwaterCharles	3
D18-05	GreenwaterHerman	3
D47-04	bideaweeCorey	3
D50-03	bideaweeMaurice	3
FF38-99R	BarkingRockMaxwell	3
T11-05	UnzickerSpeedwell	3
T81-04	GreenWaterLuis	3
T82-04	GreenWaterMike	3
T83-04	GreenWaterRames	3
T84-04	GreenWaterShawn	3
T85-04	GreenWaterDemond	3
T86-04	GreenWaterGusto	3
T95-04	bideaweeErrol	3
T96-04	bideaweeGarth	3
A122-03	4HornFarm'sIndianaJones	4
A48-98	MaverickLiberty	4
A79-98	CanberraLssac	4
B12-05	RidgecroftAustin	4
B148-98	CanberraConstible	4
B33-98	CanberraLaunce	4
B49-02	SchafewaldCyrus	4
B58-99	MaverickMallory	4
B64-99	MaverickMagnus	4
B82-04	BrokenOFrancisAlbert	4
C11-05	EdeldalAse	4



C112-04	UnzickerSilas	4
C113-04	UnzickerShubert	4
C114-04	UnzickerAshton	4
C143-03	Brink-MaySirOhm	4
C146-00	MaverickMaestro	4
C146-03	KreutzerFarmsJackson	4
C147-00	SchafewaldSam	4
C45-04	4HornFarm'sBaaNone	4
C8-05	SchafewaldRudy	4
C9-05	4HornFarm'sApache	4
D4-03	Brink-MaySirMagnum	4
T14-05	BrokenEweRambler	4
T17-05	HollowHillHandsomeBoy	4
T2-04	RidgecroftAshton	4
T25-04	UnzickerAshton	4
T27-04	UnzickerMaximillian	4
T30-05	SouthMt.Timber	4
T31-05	SouthMt.Buck	4
T35-04	SchafewaldDorito	4
T47-05	RidgecroftOtts	4
A62-04	WindyAcresMacDougal	5
A96-03	RedWingMacDunnigan	5
B73-04	MeridianApollo	5
B90-03	HillsideTom	5
B93-04	WindyAcresLexington	5
C101-01	WindyAcresLoring	5
C127-02	WindyAcresLiefErikson	5
D27-04	MeridianThor	5
D39-03	OakFarmGeorge	5
E4-04	HillsideDiandra'sDion	5
KRT72-04	KKrittersCharlie	5
T23-05	MeridianCliff	5
T24-05	MeridianGoliath	5
T39-05	WindyAcresCarlisle	5
T42-04	WindyAcresRevere	5
T68-04	ZeeWooliesAdam	5
T70-04	ZeeWooliesHarryHoudani	5
T74-04	KKrittersMarcus	5
A41-04	MeridianThunder	6
B85-03	MeridianTommy	6
B97-02	bideaweeDuke	6
C140-04	bideaweeMorgan	6
C19-05	RidgecroftAbel	6
C20-05	RidgecroftAstro	6
C203-03	ThunderHawk'sTuxedo	6
C77-02	bideaweeNoel	6
C78-99	SwallowLaneMontgomery	6
D29-04	bideaweeAnsel	6
D48-04	bideaweeAvery	6
D6-05	RidgecroftAddison	6

D7-05	RidgecroftAiden	6
FF35-98	SouthwindSirLancelot	6
T4-04	RidgecroftAragorn	6
T48-05	RidgecroftBodacious	6
T52-05	RidgecroftDesperado	6
T89-04	RidgecroftAdam	6
T97-04	bideaweeLionel	6
B114-03	SweetgrassHuron	7
C108-04	SweetgrassMathias	7
C143-99	SwallowLaneAbraham	7
C175-03	SweetgrassMinstrel	7
D42-03	SweetgrassTroubadour	7
T12-05	UnzickerAmbrose	7
T49-05	UnzickerMozart	7
T50-05	UnzickerAmadeus	7
T51-05	UnzickerMendelsohn	7